The third paper on steel was by Mr. J. R. Ravenhill, and gave an account of the improvements which have recently been made in mild steel castings. Many portions of machinery and steam-engines which till quite recently were invariably made of cast iron can now be formed of cast steel, with the attendant advantages of gain in strength and saving in weight.

Perhaps the most interesting paper of the four was that by M. Berrier Fontaine, the eminent French naval architect, "On the Use of Mild Steel for the Construction of the Hulls of Ships in the French Navy." The French were undoubtedly the first to introduce this material into the national navy; but though their experience of it is longer than our own, they do not seem to have acquired the same confidence in its use which is now felt in this country. For instance, we are in the habit of constructing the entire hulls of ships, including the below-water plating, of steel; the French, on the other hand, continue to use iron for all work which has to be exposed to the action of sea water. The reason advanced is that they find that steel when immersed in salt water corrodes with far greater rapidity than iron. M. Berrier Fontaine quotes as examples two gunboats, the *Épée* and the *Tromblon*, the hulls of which, completely steel-plated, have both given proof of rapid and deep corrosion. "The *Tromblon* was launched at Toulon on January 20, 1875, and remained afloat till October 27 of the same year. During that period of nine months it was found necessary to dock her three times, that it is to say, about every two months to paint the hull, the plates being rapidly and deeply attacked, especially in the neighbourhood of the water-line. The progress of this corrosion went on with such unusual rapidity, that when the time came to pass the *Tromblon* into the reserve it was thought necessary to haul her on to a slip instead of keeping her afloat." The whole subject of the corrosion of steel plates is at present involved in great mystery, and no two authorities seem able to agree about the cause. In the English Admiralty it is commonly believed that it is due to the presence on the surface of the plates of portions of black oxide, which constitute with the steel so many active galvanic couples, which of course rapidly promote corrosion, and hence great care is now taken to remove all traces of this oxide before the plates are coated. Whatever may be the cause, it is perfectly certain that the experience of English builders does not tally with that of M. Berrier Fontaine in this particular. Certain cases of corrosion have no doubt occurred in this country, and the hull of the *Iris* is an example in point; but as far as present experience goes such cases are the exception instead of the rule.

M. Berrier Fontaine gives an interesting account of the tools and other plant used in the French dockyards for the working of steel. He describes also the early difficulties which the workmen experienced, all of which have been successfully overcome. As regards the process of manufacture adopted in France, it appears that equally good results are obtained from the Bessemer and the Siemens methods, so much so that when contracts are given out it is never specified that the material is to be prepared by either of the two processes. In some works the Siemens system is employed for the superior sorts of steel, and the Bessemer process reserved for inferior descriptions, such as rails, while in other works exactly the opposite takes place. In this country, on the contrary, it is almost universally the rule to specify the Siemens process for the production of mild steel plates for ship-building and for boiler purposes.

## *DUNES AND MOVING SANDS*

IN a communication made to the Russian Society of Naturalists, M. Sokoloff has given a description of the dunes which are seen close by Sestroryetsk, at the eastern end of the Gulf of Finland. The whole of the isthmus between the Gulf and the basin of Sestroryetsk is covered with dunes which have a double origin. Those which are close by the sea-shore are old shore-ridges, mostly covered with vegetation, parallel to one another, and having each the form of a straight line, while those which are situated more east are true dunes, built up of sand driven by the wind. They have the direction north and south, and they reach the height of a hundred feet. Several of them are quite covered with pine-forests and with moss, while others are almost quite naked. The latter are constantly brought into motion by the west wind, and south of the Sestra River a high dune will shortly cover the houses of the working men of the Sestroryetsk manufactory. This dune, about 700 feet broad, has already covered several houses, and it is always advancing further, forming smaller parallel dunes fifteen feet high; its western side is covered with numerous excavations, from which the wind has taken the sand to move it further east. M. Sokoloff, while agreeing with the well-known classification of dunes established by the explorer of Sahara, M. Vatonne, thinks that the dunes of the deserts, which owe their origin to the action of wind, might be very easily distinguished from the mostly lower ridges which appear on the sea-shores under the influence of waves, these last usually having the form of straight lines, whilst the true dunes always have a semicircular form. M. Severtzoff observed after this communication that in the steppe of Kyzyl-koum, true dunes often have the same form of parallel, quite straight ridges. However, having at their origin a circular form which is so characteristic of the *barkhans* of the steppe, they lose by and by this form, and several smaller dunes, uniting together at their ends, take the form of a long straight ridge perpendicular to the prevailing direction of wind. M. Moushketoff, who has made a close acquaintance with the sands of Central Asia, observed that these sands, which are all sporadic, being spread among older formations, are very different as to their extent, their stratigraphical and petrographical characters, and their origin. They might be subdivided into three different classes:—1. Those which have a marine origin and which might be observed on the south-eastern shores of Lake Aral, and especially in the Kara-koum steppe. They are about 250 yards and 70 feet high, and mostly parallel to the shore. They are typical marine dunes, but their extension closely depends upon the extension of the Aralo-Caspian formation, the fossils of which are always found broken in these sands. 2. The fluvial dunes, which are very common in the valleys of the Amou, Syr, Sourkhan, and others; their height rarely exceeds 10 to fifteen feet, and their length is from 100 to 150 feet; their sand is steel-gray, and contains gypsum and clay. 3. The *barkhans* are sub-aerial formations; they prevail in the central part of the steppe Kyzyl-koum, but are rather rare in the Kara-koum steppe. They have the form of a sickle, and are somewhat conical, their maximum height being as much as 20 to 30 feet; their slopes are very different, that which is under the influence of the wind having an inclination from 5 to 13 degrees, whilst the other slope is short and steep, the inclination reaching sometimes as much as 43 degrees; they consist of a dirty-yellow or red sand, owing to their origin in the Tertiary sandstone, or sometimes in other harder rocks, as for instance, in the valley of the Ili River. Sometimes typical *barkhans* are met with among dunes, being a secondary formation arising out of the marine dunes. As to the plantations of trees on dunes, M. Moushketoff thinks that it would be far more rational first to determine whence the sand is brought by the wind, and to make the plantations of trees or bushes, according to the chemical character of the sand on this place, instead of making them on the dunes themselves.

## *UNIVERSITY AND EDUCATIONAL INTELLIGENCE*

MANCHESTER.—We learn that the Council of the Owens College proposes shortly to establish an independent Chair of Applied Mathematics.

EDINBURGH.—The tercentenary of the University of Edinburgh will be celebrated in 1883. The senatus are to invite representatives from other universities to be present; they also propose to bring out a history of the University during the first 300 years.

THE winter session of the College of Agriculture, Downton, Salisbury, was brought to a close on Wednesday, when the prizes were presented by Earl Nelson, who dwelt at considerable length on the present state and future prospects of British agriculture, taking a very hopeful view of the latter. The High Sheriff of Wilts warmly advocated such a combination of science with practice as was in vogue at the College. The Scholarship offered for competition amongst students who have completed their first year at the College was awarded to Mr. Louis Johnstone, son of Sir Harcourt Johnstone, Bart., Hockurss Hall, Scarborough, the Hon. Victor A. N. Hood *proxime accessit*.

## *SOCIETIES AND ACADEMIES*

### LONDON

**Royal Society**, March 31.—"Permanent Molecular Torsion of Conducting Wires produced by the Passage of an Electric Current," by Prof. D. E. Hughes, F.R.S.

In a paper on "Molecular Electro-Magnetic Induction," presented to the Royal Society (March 7, 1881, I gave a description of the induction currents produced by the torsion of an iron wire, and the method by which they are rendered evident. The electro-magnetic induction-balance there described is so remarkably sensitive to the slightest internal strain in anywise submitted to it, that I at once perceived that the instrument could not only determine any mechanical strain such as torsion or longitudinal stress, but that it might indicate the nature and cause of internal strains. Upon putting the question to it, Does the passage of electricity through a wire produce a change in its structure? the answer came, It does, and that to a very considerable extent; for an iron wire adjusted to perfect zero, and which would remain free from any strain for days, becomes instantaneously changed by the first passage of a current from a single cell of a Daniell's battery; the wire has now a permanent twist in a direction coinciding with that of the current, which can be brought again to zero by mechanically untwisting the wire, or undoing that which the passage of electricity has caused. Before describing the new phenomenon, I will state that the only modification required in the apparatus is a switch or key by means of which the telephone upon the wire circuit is thrown out of this circuit, and the current from a separate battery of two bichromate cells passed through the wire alone, at the same time, care being taken that no current passes through the coil, but that its circuit should remain open during the passage of the electric current through the wire under observation; an extra switch on this circuit provides for this. The reason for not allowing two currents to react upon each other, is to avoid errors of observation which may be due to this cause alone. When, however, we take an observation, the battery is upon the coil and the telephone upon the wire alone. An experiment thus consists of two operations. First all external communications interrupted, and an electric current passed through the wire; and, second, the electric currrent taken off the wire, and all ordinary communications restored. As this is done rapidly by means of the switches, very quick observations can be made, or if desired the effects of both currents can be observed at the same instant.

Now if I place upon the stress bridge a soft-iron wire ½ millim. diameter, 25 centims. long, I find, if no previous strain existed in the wire, a perfect zero, and I can make it so either by turning it slightly backwards or forwards, or by heating the wire to a red heat. If I now give a torsion of this wire, I find that its maximum value is with 40° torsion, and that this torsion represents or produces electric currents whose value in sonometric degrees is 50; each degree of torsion up to 40 produces a regular increase, so that once knowing the value of any wire, we can predict from any sonometric readings the value in torsion, or the amount of torsion in the opposite direction it would require to produce a perfect zero.

If now I place this wire at zero, and thus knowing that it is entirely free from strain I pass an electric current through it, I find that this wire is no longer free from strain, that it now gives out induction currents of the value of 40, and although there is no longer any battery current passing through this wire that the strain is permanent, the outside coil neither increasing nor diminishing the internal strain it has received by the passage of an electric current through the wire; upon giving a torsion to the wire in one direction, I find the inductive force increase from 40 to 90, but in the other direction it is brought to zero, and the amount of torsion, some 35°, required to bring the wire again to zero represents exactly the twist or strain that had been produced instantaneously by the passage of an electric current. If I repeat the experiment, but reverse the battery current sent through the wire, I find an opposite twist of exactly the same value as previously, and that it now requires an opposite torsion to again bring the wire to zero. It is not necessary however to put on an equal opposite torsion on wire to bring the currents to zero, for as I have shown in my late paper, the sonometer not only allows us to measure the force and indicate its direction, but allows us to oppose an equal electric current of opposite name, thus producing an electrical zero in place of the mechanical one produced by torsion.

Evidently here there has been a sudden change in the structure of the wire, and it is a twist which we can both measure and reproduce. The question at once becomes, Has a molar twist been given to the wire such as would be detected by the arm or free end of the wire, or a molecular change leaving no trace upon its external form of what has passed?

It will be found that, notwithstanding that it requires some 40° of torsion to annul the effects of a passage of an electric current, no visible movement nor any tendency of the free end to turn in the direction of the twist it has received can be observed. I believe however to have noticed a slight tremor or movement of half a degree, but as I could not always reproduce it, and as it is so slight compared with the 40° of internal twist, I have not taken it into account, for if the wire is firmly fastened at both ends no molar torsion being possible, except an elastic one, which would instantly spring back to zero, the current on passing produces its full effects of twist and it is permanent. Thus the molecules have in some extraordinary way rearranged themselves into a permanent twist, without the slightest external indication of so great a change having taken place. An equally remarkable change takes place in aid of, or against (according to direction of current) an elastic permanent strain. Thus, if I first put the wire under 40° right-handed permanent torsion, I find its value to be 50. Now, passing the positive of battery through its free end, and negative to fixed end, the induction currents rise at once in value to 90; if, now, the negative is momentarily passed through the free end and positive to fixed end the induced currents at once fall to 10, and these effects remain, for on taking off the elastic torsion the wire no longer comes to zero, but has the full twist value produced by the current.

Tempered steel gave only one or two degrees against fifty for soft iron, but supposing this might be due to its molecular rigidity, I carefully brought the wire to zero, and then observed the first contact only. I found then that the first contact gave a value of 40, but the second and following only one or two. By bringing the wire back to zero by a momentary touch with a magnet a continued force of 40, or if constant reversals were used instead of a simple contact, there was constant proof of a similar great molecular change by the passage of a current in steel as well as iron.

I can find no trace of the reaction of the wire upon the magnetism of the earth, as in all positions the same degree of force was obtained, if great care is taken that the wire is absolutely free from longitudinal magnetism; there is however a slight reaction upon its own return wire if brought within 1 centim. distance of the wire, and this reduces the twist some 10°. The maximum effects are obtained when the return wire is not nearer than 25 centims.; thus the action is not one produced by a reaction, but by direct action upon its internal structure.

Copper and silver wires so far show no trace of the action. I believe, however, that a similar strain takes place in all conductors, and I have obtained indirectly indications of this fact; in order, however, to verify this, would require a different method of observation from the one I have described, and I have not yet perfected the apparatus required.

It seemed probable that if I approached a strong permanent magnet to the wire, I should perceive a twist similar to that produced by the passage of a current; but no such effects were observed. But it has a most remarkable effect of instantly bringing to zero a strain produced by the current, and, no matter which pole, the effect was the same. Thus, a strain of 50°, which remains a constant, instantly disappears upon the production of longitudinal magnetism, and I have found this method of reducing an iron wire to zero of strain far more effective than any other method yet tried, such as vibrations, heat, twisting, &c.

It will be seen from this that the molecular arrangement set up by magnetism is very different from that produced by the passage of an electric current. It evidently has a structure of its own, else it would not have instantly destroyed the spiral strain left by the passage of electricity if it had not taken up a new form, as rendered evident in the longitudinal magnetism, which we could at once perceive on the wire. This question, however, belongs to a separate investigation, and I hope the apparatus will aid me later in throwing some new light upon this subject.

Another method of reducing the wire to zero, after the passage of a current, is to keep the wire in a constant state of vibration. It requires in time about one minute to bring it to zero, but if, on the contrary, I set the wire vibrating during the passage of the current, the permanent twist becomes greater and more difficult to reduce to zero.

If a wire which has internal strains is heated to redness, these strains almost entirely disappear, and I can thus reduce by heat a strain which a current had produced, but heat, whilst allowing of greater freedom and motion of its molecules, does not prevent an internal strain being set up, for whilst heat can reduce the wire to zero, after the passage of the current, the effects are increased. If, during the time that the wire is at a red heat, the

current is passed in the same time, and at the same instant we take off the current and the external heat, the wire when cold will be found to have a higher degree of strain than previously possible with the wire when cold.

We have seen that both mechanical vibrations and heat can reduce the wire to a zero, but its action is very slow, several minutes being required; but the action of electricity in producing a permanent twist is exceedingly quick. I have found that a single contact, whose duration was not more than 0·01 of a second, was equal to that of a prolonged contact of several minutes, and magnetism was equally as quick in reducing this strain to zero. And it is the more remarkable when we consider the very great mechanical force required by torsion of the wire to untwist the strain produced in an instant of time by electricity.

The results I have given are those obtained upon soft iron wires of ½ millim., but I have experimented with different sizes up to 3 millims. diameter. The results with 1 millim. diameter were quite as evident as the ½ millim., but on the 3 millim. wire the strain was reduced to 25° instead of 50°, owing to the extreme rapidity and low electrical resistance compared with my small battery wires. On a telegraph line, the wire of which is almost entirely of iron, there must be a very great strain set up, which however would remain a constant, except where reversed currents are used, and in this case a constant movement of the molecules of the wire must be the result.

I believe it to be most important that we should determine, as far as we can by experimental research, the nature of all molecular changes produced by electricity and magnetism, and in this belief I am happy in being able to bring this paper before the Royal Society.

**Chemical Society**, April 7.—Dr. Russell in the chair.—The following papers were read:—On the organic matter in sea-water, by W. Jago. The author concludes that the organic matter of sea-water is much more capable of resisting oxidising agents than that present in ordinary fresh water, and that it is probably organised and alive.—On the action of compounds inimical to bacterial life, by W. M. Hamlet. The cultivating fluids used comprised Pasteur's fluid, beef tea, hay infusion, urine, brewer's wort, and extract of meat; these were sterilised by boiling for ten minutes in Pasteur's flask, cooled with suitable precautions, and then seeded with hay solution, and the substance under examination added. Many gases, &c., were tried. Chlorine and hydric peroxide were fatal to bacteria, while chloroform, creosote, carbolic acid, salicylic acid, &c., hindered their development, but did not destroy them.

**Anthropological Institute**, March 22.—F. W. Rudler, F.G.S., vice-president, in the chair.—The election of George B. Waterhouse was announced.—Mr. R. W. Felkin exhibited a series of photographs of scenes and natives of Central Africa, taken by Herr Buchta.—Prof. Flower, F.R.S., exhibited a collection of crania from the Island of Mallicollo in the New Hebrides, which had been lately presented to the Museum of the Royal College of Surgeons by Mr. Luther Holden. The peculiar conformation of the heads of the people of this island attracted the attention of Capt. Cook and the naturalist Forster, who accompanied the great navigator on his second voyage, and who writes that "the depressed and backward inclining forehead causes an appearance in the looks and countenances of the natives similar to those of monkeys." Yet Cook bears testimony to the activity, intelligence, and honesty of this "ape-like nation," as he calls them. A few years ago Mr. Busk described some skulls collected in the island by the late Commodore Goodenough, and found that they all showed signs of having undergone alterations in form from pressure applied in infancy. The present collection corroborates Mr. Busk's views; some of the skulls being deformed to a remarkable degree, and closely resembling the well-known Peruvian crania from the neighbourhood of Lake Titicaca. This is the more remarkable, as on no other of the numerous islands of the neighbouring ocean is the practice known to exist. Besides the deformed crania the collection contained several monumental heads, said to be those of chiefs. In these the features are modelled in clay upon the skull, apparently with the intention of preserving a likeness of the dead person; the face is painted over with red ochre, artificial eyes introduced, and the hair elaborately dressed and ornamented with feathers. In one case the hair had been entirely removed, and a very neatly-made wig substituted. The head thus prepared is stuck upon a rudely-made figure of split bamboo and clay, and set up in the village temple, with the weapons and small personal effects of the deceased. This is a custom not hitherto known to exist among the Mallicollese, and its motive is not completely understood, but it is obviously analogous to many others which have prevailed throughout all historical times and in many nations, manifesting itself, among other forms, in the mummified bodies of the Ancient Egyptians and the marble busts over the mouldering bones in Westminster Abbey.—Mr. Joseph Lucas read a paper on the ethnological bearings of the terms Gipsy, Zingaro, Rom, &c.

**Zoological Society**, April 5.—Prof. W. H. Flower, LL.D., F.R.S., president, in the chair.—Mr. Sclater exhibited five bird's skins obtained by the Rev. G. Brown, C.M.Z.S., on the Island of Rotumeh, and presented by him to the *Challenger* Expedition. Mr. Sclater also exhibited specimens of two new species of birds from New Britain, belonging to the Museum Godeffroi, which he proposed to call *Trichoglossus rufigularis* and *Ortygocichla rubiginosa*.—Mr. H. E. Dresser exhibited and made remarks on a specimen of *Saxicola deserti* killed in Scotland, and a specimen of *Picus pubescens* believed to have been killed in Normandy.—Mr. W. A. Forbes, F.Z.S., read some notes on the external characters and anatomy of the Californian Sea Lion (*Otaria gillespii*), and exhibited some coloured drawings of this animal.—Prof. Flower, F.R.S., read a note upon the habits of the Manatee, chiefly in reference to the question as to whether this animal had the power of voluntarily leaving the water for the purpose of feeding on the herbage of the banks, as stated by many authors, and as supported by a communication from the late Mr. R. B. Dobree, notwithstanding which Prof. Flower considered the evidence upon which the statement was based to be very unsatisfactory.—A paper was read upon the same animal by Miss Agnes Crane, consisting of observations upon the Manatees lately living in the Brighton Aquarium.—Dr. A. Günther, F.R.S., read an account of the Amphisbænians and Ophidians collected by Prof. Bayley Balfour in the Island of Socotra. A new form of snakes allied to *Tachymenis* was named *Dityophis vivax*, a new species of *Zamenis* was named *Z. Socotræ*, and a new form of Amphisbænian *Pachycalamus brevis*.—Mr. W. T. Blanford, F.R.S., gave an account of six species of lizards which had been collected by Prof. Bayley Balfour in Socotra; of these the three following appeared to be undescribed:—*Hemidactylus homœolepis*, *Pristurus insignis*, and *Eremias Balfouri*.—Mr. Charles O. Waterhouse read a paper on the coleopterous insects which had been collected by Prof. Bayley Balfour in Socotra. The number of species of which examples were collected was twenty-four, and showed that the fauna of Socotra, judging from this collection, was distinctly African. Twelve of the species appeared to be new.—A communication was read from Prof. J. O. Westwood containing observations on two species of Indian butterfles, *Papilio castor* and *P. pollux*.—A communication was read from Mr. Edgar A. Smith, containing some observations on the shells belonging to the genus *Gouldia* of C. B. Adams.—Mr. Sclater read the fifth of his series of notes on the birds of the vicinity of Lima, Peru, with remarks on their habits by Prof. Nation, C.M.Z.S. A new species of *Buarremon*, of which an example was in the collection, was proposed to be dedicated to its discoverer as *B. Nationi*.—Mr. G. E. Dobson read some notes on certain points in the muscular anatomy of the Green Monkey, *Cercopithecus callithrix*.

EDINBURGH

**Royal Society**, March 21.—Sir Wyville Thomson, vice-president, in the chair.—Prof. Geikie communicated a paper by Mr. C. A. Stevenson, B.Sc., on the earthquake of November 28, 1880, in Scotland and Ireland. The main conclusions at which the author arrived were the following:—The centre of the disturbance was at a point some thirteen miles south-west of Fladda, in the continuation of the line of the fault that lies along the great glen which stretches in a south-westerly direction from Inverness. The disturbance was felt over an area of 19,000 square miles, extending as far east as Blair Athole, as far north as the Butt of Lewis, and as far south as Armagh in Ireland. The undulation was everywhere of an up-and-down character; its breadth was estimated at 1100 feet, and its velocity seemed to vary from 3·75 to 7·75 miles per minute, having a mean value of 6·75 over the sea and 4·68 over the land. The accompanying rumbling was not heard at all the stations, and appeared to have been best heard where but little soil covered the hard dense substratum of rock. The disturbance was felt better over the older rocks. Noises were not heard outside a radius of 38 miles from the centre, except in the north of Ireland, where however it was

suggested that the noise was due to the indirect action of the earthquake in causing a secondary local disturbance.—Mr. P. Geddes read his first communication on the classification of statistics. After pointing out the utter confusion that exists in many of the national classifications of the present time, the author criticised the arrangements suggested by Deloche and Mouat, which were equally unsatisfactory, because of their unscientific and artificial methods. Any classification, to be natural, must be based upon some broad principle common to all kinds of communities or societies. A fundamental meaning must therefore be attached to the word society—a definition given to it that will include societies of all kinds of organisms. Such a definition must obviously take account of the vital functions of organisms in relation to the matter and energy of the universe. We have thus matter and energy on the one hand, organisms on the other. Mr. Geddes, confining himself meanwhile to the first of these two great divisions, proceeded to classify the sources of energy, adopting the classification given by Prof. Tait in his Thermodynamics, and showing how naturally such things as food, fuel, machines, &c., fell into their places in such an arrangement. He then considered the classification of sources of matter used for other than energy-properties, taking for this purpose the well-known three-fold division into minerals, vegetables, and animals. The development of ultimate products through their successive phases of raw material, manufacture, exportation, trade, &c., and the classification of all products under the three chief headings of potential, mediate, and ultimate, completed the one aspect of the statistical method in so far as it related to the matter and energy of the universe. It still remained however to take account of the loss, or more properly the degradation or dissipation, suffered. The classification must indicate not only the kind of loss, *e.g.* whether in raw material, in manufacture, in trade, in ultimate product, or in remedial effort, but also the agency that was the direct cause of the loss, whether physical, as earthquake, flood, storm, &c.; or biological, as insects, fungi, &c.; or social, as crime, war, or folly.—Mr. T. Muir communicated three mathematical notes: on Prof. Cayley's theorem regarding a bordered skew determinant; on the law of extensible minors in determinants; and on a problem of arrangement.—Mr. J. Y. Buchanan read a short paper on the oxidation of ferrous salts.—Prof. Tait made a brief communication on some space loci.

PARIS

**Academy of Sciences**, April 4.—M. Wurtz in the chair.—M. de Quatrefages presented an example of the Edwards Medal.—The following papers were read:—On micrometric measurements during the transit of Venus of 8 December, 1874, by M. Puiseux. These measurements (393 in number and in five categories) at St. Paul and Pekin fairly agree, though the conditions were unfavourable, and give for the parallax 9″·05.—On the same subject, by M. Mouchez. He considers the method is to be strongly recommended for 1882.—Note on the methods of Wronski, by M. Villarceau.—On photographic photometry and its application to study of the comparative radiating powers of the sun and of stars, by M. Janssen. A shutter with triangular aperture is made to pass with uniform motion of known rate before a sensitised plate; this gives (with light) a series of shades on the plate, decreasing from the base side to the apex side. To compare the sensibility of two plates, differently prepared, or the photogenic intensity of two sources (using two like plates) the points of equal shade on the plates are noted. (The photographic intensity does not increase as rapidly as the luminous intensity.) For the sun he finds the time of action (with gelatine bromide of silver plates) must be reduced to $\frac{1}{40000}$ sec. to give the most rapid variation in the opacity. The sides of the slit are curved (for a special reason). A series of circular images of stars are obtained by putting the plate a little out of focus.—On alcoholate of chloral, by M. Berthelot.—On lightning flashes without thunder, by M. d'Abbadie. He observed such quite near, in a fog, when in Ethiopia.—On the combinations of phtalic anhydride with hydrocarbons of the benzene series, by MM. Friedel and Crafts.—Note on chalcomenite, a new mineral species (selenite of copper), by MM. des Cloizeaux and Damour. This is from near Mendoza in the Argentine Republic.—Researches on changes of state near the critical point of temperature, by MM. Cailletet and Hautefeuille. By colouring carbonic acid the liquid is rendered always visible. It is found that Andrews's undulatory striæ dissolve blue oil of galbanum, so that they are produced by streaks of liquefied carbonic acid. Neither in disappearance of a meniscus through compression, nor in change of state at the critical temperature does matter pass by insensible degrees from the liquid to the gaseous state.—Magnetic anomaly of meteoric iron of Santa Catharina, by Prof. Lawrence Smith. Small fragments are very feebly affected by a magnet till they have been flattened on a steel surface with a steel hammer, or heated red hot.—Attenuation of effects of virulent inoculations by use of small quantities of virus, by M. Chauveau.—M. Jordan was elected Member in Geometry in room of the late M. Chasles.—On the winter egg of phylloxera, by M. Lichtenstein.—Researches on the causes which enable the vine to resist phylloxera in sandy soils, by M. Saint-André. Weak capillary capacity of a soil seems to be the direct or indirect cause of the resistance of vines.—On the bismuthine produced by coal-mines on fire, by M. Mayençon.—On functions proceeding from Gauss's equation, by M. Halphen.—On a new application and some important properties of Fuchsian functions, by M. Poincaré.—On the relations between solar spots and magnetic variations, by M. Wolf. Tables for 1880 are given. The solar curve is also shown to be quickly rising again; a maximum may be expected in 1882 to 1883. The increase of magnetic declination for 1879-80 is 1′·18 by formula, 0′·99 by observation.—On the viscosity of gases, by Mr. Crookes.—Luminous intensity of radiations emitted by incandescent platinum, by M. Violle. From observations ranging from 775° to 1775° he constructs a formula.—On the change of volume accompanying the galvanic deposit of a metal, by M. Bouty. It is always possible in electrolysis of the same salt to diminish the intensity of current below a certain limit such that the compression produced by the deposit is then changed into attraction (the metal dilating instead of contracting in solidifying).—On the voltaic conductivity of heated gases, by M. Blondlot. He describes an experiment made by way of putting the conductivity of gases beyond doubt, and in which all parts of the apparatus are constantly open to inspection.—On the internal discharges of electric condensers, by M. Villari. The laws of the phenomenon are enunciated.—On magical mirrors, by M. Laurent. A common silvered mirror of any thickness may be rendered magical by means of heat; *e.g.* applying the end of a heated brass tube to it. The section of the tube is imaged.—On hydrosulphite of soda, by M. 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